ATGAGAACATTAAAAAACCTCATAACTGTTGTGGCCTTTAGTATTTTTTGGGTACTGTTGATTTACGTCAAT 72

GTTTATCTCTTTGGTGCTAAAGGAAGCTTGTCAATTTATGGCTTTTTGCTGATAGCTTACCTATTAGTCAAA 144

ATGTCCTTATCCTTTTTTTACAAGCCATTTAAGGGAAGGGCTGGGCAATATAAGGTTGCAGCCATTATTCCC 216

TCTTATAACGAAGATGCTGAGTCATTGCTAGAGACCTTAAAAAGTGTTCAGCAGCAAACCTATCCCCTAGCA 288

GAAATTTATGTTGTTGACGATGGAAGTGCTGATGAGACAGGTATTAAGCGCATTGAAGACTATGTGCGTGAC 360

ACTGGTGACCTATCAAGCAATGTCATTGTTCATCGGTCAGAGAAAAATCAAGGAAAGCGTCATGCACAGGCC 432

TGGGCCTTTGAAAGATCAGACGCTGATGTCTTTTTGACCGTTGACTCAGATACTTATATCTACCCTGATGCT 504

TTAGAGGAGTTGTTAAAAACCTTTAATGACCCAACTGTTTTTGCTGCGACGGGTCACCTTAATGTCAGAAAT 576

AGACAAACCAATCTCTTAACACGCTTGACAGATATTCGCTATGATAATGCTTTTGGCGTTGAACGAGCTGCC 648

CAATCCGTTACAGGTAATATCCTTGTTTGCTCAGGTCCGCTTAGCGTTTACAGACGCGAGGTGGTTGTTCCT 720

AACATAGATAGATACATCAACCAGACCTTCCTGGGTATTCCTGTAAGTATTGGTGATGACAGGTGCTTGACC 792

AACTATGCAACTGATTTAGGAAAGACTGTTTATCAATCCACTGCTAAATGTATTACAGATGTTCCTGACAAG 864

ATGTCTACTTACTTGAAGCAGCAAAACCGCTGGAACAAGTCCTTCTTTAGAGAGTCCATTATTTCTGTTAAG 936

AAAATCATGAACAATCCTTTTGTAGCCCTATGGACCATACTTGAGGTGTCTATGTTTATGATGCTTGTTTAT 1008

TCTGTGGTGGATTTCTTTGTAGGCAATGTCAGAGAATTTGATTGGCTCAGGGTTTTAGCCTTTCTGGTGATT 1080

ATCTTCATTGTTGCCCTGTGTCGGAACATTCATTACATGCTTAAGCACCCGCTGTCCTTCTTGTTATCTCCG 1152

TTTTATGGGGTGCTGCATTTGTTTGTCCTACAGCCCTTGAAATTATATTCTCTTTTTACTATTAGAAATGCT 1224

GACTGGGGAACACGTAAAAAATTATTATAA 1254

SEQUENCE ID NO. 1

M R T L K N L I T V V A F S I F W V L L I Y V N 24

V Y L F G A K G S L S I Y G F L L I A Y L L V K 48

M S L S F F Y K P F K G R A G Q Y K V A A I I P 72

S Y N E D A E S L L E T L K S V Q Q Q T Y P L A 96

E I Y V V D D G S A D E T G I K R I E D Y V R D 120

T G D L S S N V I V H R S E K N Q G K R H A Q A 144

W A F E R S D A D V F L T V D S D T Y I Y P D A 168

L E E L L K T F N D P T V F A A T G H L N V R N 192

R Q T N L L T R L T D I R Y D N A F G V E R A A 216

Q S V T G N I L V C S G P L S V Y R R E V V V P 240

N I D R Y I N Q T F L G I P V S I G D D R C L T 264

N Y A T D L G K T V Y Q S T A K C I T D V P D K 288

M S T Y L K Q Q N R W N K S F F R E S I I S V K 312

K I M N N P F V A L W T I L E V S M F M M L V Y 336

S V V D F F V G N V R E F D W L R V L A F L V I 360

I F I V A L C R N I H Y M L K H P L S F L L S P 384

F Y G V L H L F V L Q P L K L Y S L F T I R N A 408

D W G T R K K L L * 417

SEQUENCE ID NO. 2

SEQUENCE ID NO. 3

5'-GCTGATGAG ACAG G TAT TAAGC

primer: sel (sense, nucleotides G^{316} - C^{337})

SEQUENCE ID NO. 4

5'-A T C A A A T T C T C T G A C A T T G C

primer: se2 (antisense, for sense nucleotides G^{1031} - T^{1050})

SEQUENCE ID NO. 5

5'-G A C T C A G A T A C T T A T A T C T A

primer: sesp1 (sense, for nucleotides G^{475} - A^{494})

SEQUENCE ID NO. 6

5'-T T T T T A C G T G T T C C C C A

primer: sesp2 (antisense, for sense nucleotides T^{1228} – A^{1244})

Protein sequence of A98R, the PBCV-1 HA synthase

```
1     MGKNIIIMVS WYTIITSNLI AVGGASLILA PAITGYVLHW NIALSTIWGV SAYGIFVFGF
61    FLAQVLFSEL NRKRLRKWIS LRPKGWNDVR LAVIIAGYRE DPYMFQKCLE SVRDSDYGNV
121   ARLICVIDGD EDDDMRMAAV YKAIYNDNIK KPEFVLCESD DKEGERIDSD FSRDICVLQP
181   HRGKRECLYT GFQLAKMDPS VNAVVLIDSD TVLEKDAILE VVYPLACDPE IQAVAGECKI
241   WNTDTLLSLL VAWRYYSAFC VERSAQSFFR TVQCVGGPLG AYKDIIKEIK DPWISQRFLG
301   QKCTYGDDRR LTNEILMRGK KVVFTPFAVG WSDSPTNVFR YIVQQTRWSK SWCREIWYTL
361   FAAWKHGLSG IWLAFECLYQ ITYFFLVIYL FSRLAVEADP RAQTATVIVS TTVALIKCGY
421   FSFRAKDIRA FYFVLYTFVY FFCMIPARIT AMMTLWDIGW DTRGGNEKPS VGTRVALWAK
481   QYLIAYMWWA AVVGAGVYSI VHNWMFDWNS LSYRFALVGI CSYIVFIVIV LVVYFTGKIT
541   TWNFTKLQKE LIEDRVLYDA TTNAQSV
                                    567
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SEQUENCE ID NO. 7

Nucleotide Sequence of A98R gene in the PBCV-1 Virus Genome

Start: ATG 50901 Stop: TGA 52607

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50881 aagacttctt gaaagttaca ATGggtaaaa atataatcat aatggtttcg tggtacacca
50941 tcataacttc aaatctaatc gcggttggag gagcctctct aatcttggct ccggcaatta
51001 ctgggtatgt tctacattgg aatattgctc tctcgacaat ctggggagta tcagcttatg
51061 gtattttcgt ttttgggttt ttccttgcac aagttttatt ttcagaactg aacaggaaac
51121 gtcttcgcaa gtggatttct ctcagaccta agggttggaa tgatgttcgt ttggctgtga
51181 tcattgctgg atatcgcgag gatccttata tgttccagaa gtgcctcgag tctgtacgtg
51241 actctgatta tggcaacgtt gcccgtctga tttgtgtgat tgacggtgat gaggacgatg
51301 atatgaggat ggctgccgtt tacaaggcga tctacaatga taatatcaag aagcccgagt
51361 ttgttctgtg tgagtcagac gacaaggaag gtgaacgcat cgactctgat ttctctcgcg
51421 acatttgtgt cctccagcct catcgtggaa aacgggagtg tctttatact gggtttcaac
51481 ttgcaaagat ggaccccagt gtcaatgctg tcgttctgat tgacagcgat accgttctcg
51541 agaaggatgc tattctggaa gttgtatacc cacttgcatg cgatcccgag atccaagccg
51601 ttgcaggtga gtgtaagatt tggaacacag acactctttt gagtcttctc gtcgcttggc
51661 ggtactattc tgcgttttgt gtggagagga gtgcccagtc ttttttcagg actgttcagt
51721 gcgttggggg gccactgggt gcctacaaga ttgatatcat taaggagatt aaggacccct
51781 ggatttccca gcgctttctt ggtcagaagt gtacttacgg tgacgaccgc cggctaacca
51841 acgagatctt gatgcgtggt aaaaaggttg tgttcactcc atttgctgtt ggttggtctg
51901 acagtccgac caatgtgttt cggtacatcg ttcagcagac ccgctggagt aagtcgtggt
51961 gccgcgaaat ttggtacacc ctcttcgccg cgtggaagca cggtttgtct ggaatttggc
52021 tggcctttga atgtttgtat caaattacat acttcttcct cgtgatttac ctcttttctc
52081 gcctagccgt tgaggccgac cctcgcgccc agacagccac ggtgattgtg agcaccacgg
52141 ttgcattgat taagtgtggg tatttttcat tccgagccaa ggatattcgg gcgttttact
52201 ttgtgcttta tacatttgtt tactttttct gtatgattcc ggccaggatt actgcaatga
52261 tgacgctttg ggacattggc tgggatactc gcggtggaaa cgagaagcct tccgttggca
52321 cccgggtcgc tctgtgggca aagcaatatc tcattgcata tatgtggtgg gccgcggttg
52381 ttggcgctgg agtttacagc atcgtccata actggatgtt cgattggaat tctctttctt
52441 atcgttttgc tttggttggt atttgttctt acattgtttt tattgttatt gtgctggtgg
52501 tttatttcac cggcaaaatt acgacttgga atttcacgaa gcttcagaag gagctaatcg
52561 aggatcgcgt tctgtacgat gcaactacca atgctcagtc tgtgTGAttt ttcctgcaag
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SEQUENCE ID NO. 8

Nucleotide and Protein Sequence of Pasteurella multocida

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                                              +1®
   1                    M  N  T  L  S  Q  A  I  K  A  Y  N  S  N  D  Y  Q
 -18  ATTTTTAAGGACAGAAAATGAATACATTATCACAAGCAATAAAAGCATATAACAGCAATGACTATCAA

  18  L  A  L  K  L  F  E  K  S  A  E  I  Y  G  R  K  I  V  E  F  Q  I  T
  52  TTAGCACTCAAATTATTTGAAAAGTCGGCGGAAATCTATGGACGGAAAATTGTTGAATTTCAAATTACC

  41  K  C  Q  E  K  L  S  A  H  P  S  V  N  S  A  H  L  S  V  N  K  E  E
 121  AAATGCCAAGAAAAACTCTCAGCACATCCTTCTGTTAATTCAGCACATCTTTCTGTAAATAAAGAAGAA

  64  K  V  N  V  C  D  S  P  L  D  I  A  T  Q  L  L  L  S  N  V  K  K  L
 190  AAAGTCAATGTTTGCGATAGTCCGTTAGATATTGCAACACAACTGTTACTTTCCAACGTAAAAAAATTA

  87  V  L  S  D  S  E  K  N  T  L  K  N  K  W  K  L  L  T  E  K  K  S  E
 259  GTACTTTCTGACTCGGAAAAAAACACGTTAAAAAATAAATGGAAATTGCTCACTGAGAAGAAATCTGAA

 110  N  A  E  V  R  A  V  A  L  V  P  K  D  F  P  K  D  L  V  L  A  P  L
 328  AATGCGGAGGTAAGAGCGGTCGCCCTTGTACCAAAAGATTTTCCCAAAGATCTGGTTTTAGCGCCTTTA

 133  P  D  H  V  N  D  F  T  W  Y  K  K  R  K  K  R  L  G  I  K  P  E  H
 397  CCTGATCATGTTAATGATTTTACATGGTACAAAAAGCGAAAGAAAAGACTTGGCATAAAACCTGAACAT

 156  Q  H  V  G  L  S  I  I  V  T  T  F  N  R  P  A  I  L  S  I  T  L  A
 466  CAACATGTTGGTCTTTCTATTATCGTTACAACATTCAATCGACCAGCAATTTTATCGATTACATTAGCC

 179  C  L  V  N  Q  K  T  H  Y  P  F  E  V  I  V  T  D  D  G  S  Q  E  D
 535  TGTTTAGTAAACCAAAAAACACATTACCCGTTTGAAGTTATCGTGACAGATGATGGTAGTCAGGAAGAT

 202  L  S  P  I  I  R  Q  Y  E  N  K  L  D  I  R  Y  V  R  Q  K  D  N  G
 604  CTATCACCGATCATTCGCCAATATGAAAATAAATTGGATATTCGCTACGTCAGACAAAAAGATAACGGT

 225  F  Q  A  S  A  A  R  N  M  G  L  R  L  A  K  Y  D  F  I  G  L  L  D
 673  TTTCAAGCCAGTGCCGCTCGGAATATGGGATTACGCTTAGCAAAATATGACTTTATTGGCTTACTCGAC

 248  C  D  M  A  P  N  P  L  W  V  H  S  Y  V  A  E  L  L  E  D  D  D  L
 742  TGTGATATGGCGCCAAATCCATTATGGGTTCATTCTTATGTTGCAGAGCTATTAGAAGATGATGATTTA

 271  T  I  I  G  P  R  K  Y  I  D  T  Q  H  I  D  P  K  D  F  L  N  N  A
 811  ACAATCATTGGTCCAAGAAAATACATCGATACACAACATATTGACCCAAAAGACTTCTTAAATAACGCG

 294  S  L  L  E  S  L  P  E  V  K  T  N  N  S  V  A  A  K  G  E  G  T  V
 880  AGTTTGCTTGAATCATTACCAGAAGTGAAAACCAATAATAGTGTTGCCGCAAAAGGGGAAGGAACAGTT

 317  S  L  D  W  R  L  E  Q  F  E  K  T  E  N  L  R  L  S  D  S  P  F  R
 949  TCTCTGGATTGGCGCTTAGAACAATTCGAAAAAACAGAAAATCTCCGCTTATCCGATTCGCCTTTCCGT

 340  F  F  A  A  G  N  V  A  F  A  K  K  W  L  N  K  S  G  F  F  D  E  E
1018  TTTTTTGCGGCGGGTAATGTTGCTTTCGCTAAAAAATGGCTAAATAAATCCGGTTTCTTTGATGAGGAA
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 363   F  N  H  W  G  G  E  D  V  E  F  G  Y  R  L  F  R  Y  G  S  F  F  K
1087   TTTAATCACTGGGGTGGAGAAGATGTGGAATTTGGATATCGCTTATTCCGTTACGGTAGTTTCTTTAAA

 386   T  I  D  G  I  M  A  Y  H  Q  E  P  P  G  K  E  N  E  T  D  R  E  A
1156   ACTATTGATGGCATTATGGCCTACCATCAAGAGCCACCAGGTAAAGAAAATGAAACCGATCGTGAAGCG

 409   G  K  N  I  T  L  D  I  M  R  E  K  V  P  Y  I  Y  R  K  L  L  P  I
1225   GGAAAAAATATTACGCTCGATATTATGAGAGAAAAGGTCCCTTATATCTATAGAAAACTTTTACCAATA

 432   E  D  S  H  I  N  R  V  P  L  V  S  I  Y  I  P  A  Y  N  C  A  N  Y
1294   GAAGATTCGCATATCAATAGAGTACCTTTAGTTTCAATTTATATCCCAGCTTATAACTGTGCAAACTAT

 455   I  Q  R  C  V  D  S  A  L  N  Q  T  V  V  D  L  E  V  C  I  C  N  D
1363   ATTCAACGTTGCGTAGATAGTGCACTGAATCAGACTGTTGTTGATCTCGAGGTTTGTATTTGTAACGAT

 478   G  S  T  D  N  T  L  E  V  I  N  K  L  Y  G  N  N  P  R  V  R  I  M
1432   GGTTCAACAGATAATACCTTAGAAGTGATCAATAAGCTTTATGGTAATAATCCTAGGGTACGCATCATG

 501   S  K  P  N  G  G  I  A  S  A  S  N  A  A  V  S  F  A  K  G  Y  Y  I
1501   TCTAAACCAAATGGCGGAATAGCCTCAGCATCAAATGCAGCCGTTTCTTTTGCTAAAGGTTATTACATT

 524   G  Q  L  D  S  D  D  Y  L  E  P  D  A  V  E  L  C  L  K  E  F  L  K
1570   GGGCAGTTAGATTCAGATGATTATCTTGAGCCTGATGCAGTTGAACTGTGTTTAAAAGAATTTTTAAAA

 547   D  K  T  L  A  C  V  Y  T  T  N  R  N  V  N  P  D  G  S  L  I  A  N
1639   GATAAAACGCTAGCTTGTGTTTATACCACTAATAGAAACGTCAATCCGGATGGTAGCTTAATCGCTAAT

 570   G  Y  N  W  P  E  F  S  R  E  K  L  T  T  A  M  I  A  H  H  F  R  M
1708   GGTTACAATTGGCCAGAATTTTCACGAGAAAAACTCACAACGGCTATGATTGCTCACCACTTTAGAATG

 593   F  T  I  R  A  W  H  L  T  D  G  F  N  E  K  I  E  N  A  V  D  Y  D
1777   TTCACGATTAGAGCTTGGCATTTAACTGATGGATTCAATGAAAAAATTGAAAATGCCGTAGACTATGAC

 616   M  F  L  K  L  S  E  V  G  K  F  K  H  L  N  K  I  C  Y  N  R  V  L
1846   ATGTTCCTCAAACTCAGTGAAGTTGGAAAATTTAAACATCTTAATAAAATCTGCTATAACCGTGTATTA

 639   H  G  D  N  T  S  I  K  K  L  G  I  Q  K  K  N  H  F  V  V  V  N  Q
1915   CATGGTGATAACACATCAATTAAGAAACTTGGCATTCAAAAGAAAAACCATTTTGTTGTAGTCAATCAG

 662   S  L  N  R  Q  G  I  T  Y  Y  N  Y  D  E  F  D  D  L  D  E  S  R  K
1984   TCATTAAATAGACAAGGCATAACTTATTATAATTATGACGAATTTGATGATTTAGATGAAAGTAGAAAG

 685   Y  I  F  N  K  T  A  E  Y  Q  E  E  I  D  I  L  K  D  I  K  I  I  Q
2053   TATATTTTCAATAAAACCGCTGAATATCAAGAAGAGATTGATATCTTAAAAGATATTAAAATCATCCAG

 708   N  K  D  A  K  I  A  V  S  I  F  Y  P  N  T  L  N  G  L  V  K  K  L
2122   AATAAAGATGCCAAAATCGCAGTCAGTATTTTTATCCCAATACATTAAACGGCTTAGTGAAAAAACTA

 731   N  N  I  I  E  Y  N  K  N  I  F  V  I  V  L  H  V  D  K  N  H  L  T
2191   AACAATATTATTGAATATAATAAAAATATATTCGTTATTGTTCTACATGTTGATAAGAATCATCTTACA

 754   P  D  I  K  K  E  I  L  A  F  Y  H  K  H  Q  V  N  I  L  L  N  N  D
2260   CCAGATATCAAAAAAGAAATACTAGCCTTCTATCATAAACATCAAGTGAATATTTTACTAAATAATGAT
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SEQUENCE ID NO. 9
(Page 2 of 3)

777 I S Y Y T S N R L I K T E A H L S N I N K L S
2329 ATCTCATATTACACGAGTAATAGATTAATAAAAACTGAGGCGCATTTAAGTAATATTAATAAATTAAGT

800 Q L N L N C E Y I I F D N H D S L F V K N D S
2398 CAGTTAAATCTAAATTGTGAATACATCATTTTTGATAATCATGACAGCCTATTCGTTAAAAATGACAGC

823 Y A Y M K K Y D V G M N F S A L T H D W I E K
2467 TATGCTTATATGAAAAAATATGATGTCGGCATGAATTTCTCAGCATTAACACATGATTGGATCGAGAAA

846 I N A H P P F K K L I K T Y F N D N D L K S M
2536 ATCAATGCGCATCCACCATTTAAAAAGCTCATTAAAACTTATTTTAATGACAATGACTTAAAAAGTATG

869 N V K G A S Q G M F M T Y A L A H E L L T I I
2605 AATGTGAAAGGGGCATCACAAGGTATGTTTATGACGTATGCGCTAGCGCATGAGCTTCTGACGATTATT

892 K E V I T S C Q S I D S V P E Y N T E D I W F
2674 AAAGAAGTCATCACATCTTGCCAGTCAATTGATAGTGTGCCAGAATATAACACTGAGGATATTTGGTTC

915 Q F A L L I L E K K T G H V F N K T S T L T Y
2743 CAATTTGCACTTTTAATCTTAGAAAAGAAAACCGGCCATGTATTTAATAAAACATCGACCCTGACTTAT

938 M P W E R K L Q W T N E Q I E S A K R G E N I
2812 ATGCCTTGGGAACGAAAATTACAATGGACAAATGAACAAATTGAAAGTGCAAAAAGAGGAGAAAATATA

961 P V N K F I I N S I T L *
2881 CCTGTTAACAAGTTCATTATTAATAGTATAACTCTATAA